



MOTOROLA

AlphaMate II

Paging Entry Terminal

Model N1593A (110VAC)

Model N1595A (220VAC)



Service & Repair Manual



6881003B22-0

GENERAL INFORMATION

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GENERAL SAFETY INSTRUCTIONS FOR AC LINE OPERATED EQUIPMENT

The installation, maintenance, and operation of this device presents potential unsafe conditions, including, but not limited to electrical shock, improper voltage to components, and improper operation which may cause personal injury or damage to property.

Read Instructions - All the safety instructions should be read before the equipment is operated and should be retained for future reference. Specialized procedures and instructions are required and must be followed when working on the system. Additionally, all applicable safety procedures, such as OSHA requirements, National Electric Code Requirements, local code requirements, safe working practices, and good judgment must be used by personnel when installing, operating, and/or maintaining the equipment.

Heed Warnings - All warnings on the equipment and in the operating instructions should be adhered to. All operating and use instructions should be followed. Safety, as defined in this instruction manual involves two conditions:

- Personal injury or death.
- Product or property damage (includes damage to the system and other components).

DANGER

A danger notation is a hazard or unsafe practice which will result in severe personal injury, death or property damage.

WARNING

A warning notation is a hazard or unsafe practice which could result in severe personal injury, death or property damage.

Mounting - The equipment should be mounted only as recommended by the manufacturer. The equipment should be situated away from heat sources such as radiators, heat registers, stoves, or other equipment (including amplifiers) that produce heat.

Power Sources and Grounding - The equipment should be connected to a power source only of the type described in the installation instructions or as marked on the equipment. Precautions should be taken so that the grounding or polarization means of the equipment is not defeated. Power to the equipment should be disconnected by circuit breaker when left unused for long periods of time.

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- The equipment does not appear to operate normally or exhibits a change in performance;
- The equipment has been dropped, or the enclosure damaged.
- The user should not attempt to service the equipment beyond that described in the operating instructions. All other servicing should be referred to qualified service personnel.

Telephone Line Installation - All telephone line connections to the punchblock should be accomplished with the telephone lines disconnected from the network interface.

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Crystal or channel element orders should specify the crystal or channel element type number, crystal and

carrier frequency, and the model number in which the part is used.

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The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunication network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION

Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The LOAD NUMBER (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of device subject only to the requirement that the total of the Load Numbers of all the devices to not exceed 100%.

DOC Compliance Statement

This digital apparatus does not exceed the class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of communications.

MDC Avia De Conformation

Le present appareil numerique n'emet pas de bruits radioelectriques dwpassant les limites applicables aux appareils numeriques de Classe B prescrites dans le Reglement sur le brouillage radioelectriques edicte par le ministre des Communicationws du Canada.

FCC Compliance Statement

WARNING

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

NOTE

This device complies with Part 15 of CCC Rules. Operation is subject to the following conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment gener-

ates, uses and can radiate radio frequency energy and, if not installed and used in accordance with manufacturer's instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Re-orient or relocate the receiving antenna

Increase the separation between the equipment and receiver

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

AlphaMate II

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FEATURES AND SPECIFICATIONS

Hardware:

Models: N1593A for 110VAC
N1595A for 220VAC

Keyboard: Standard typewriter-type keyboard with tactile feedback

Display: 80-character, 2-line LCD display with software contrast control

Autodialer: Built-in DTMF and pulse dialer.

Connectors:

One RS232-C serial port for connection to:

- Printer
- Another AlphaMate
- Paging Terminal

One parallel port for connecting a printer

Two RJ11C connectors for connection to:

- Telephone
- Telephone line

One 7.5Vdc (200 - 250mA) power input jack.

Modem: Built-in 300 to 1200 Baud Bell 103/212 compatible modem.

Speaker: Internal speaker with software volume control.

Power: 110Vac, 60Hz or 220Vac 50/60Hz power supply that delivers 7.5Vdc at 200 to 250ma.

Dimensions: 4" x 8" x 12"

Weight: 3 lbs

Operating Temp: 0 to 50 degrees C

Software:

Dual password protection

Local and Remote programming via RS-232 or Modem by using another AlphaMate II or a terminal

A realtime clock allows the user to preprogram paging functions to be executed at a later time

The paging directory will hold 750 entries of 20 characters each.

Canned messages are supported

Support for up to 10 different paging systems (10 different telephone numbers and 10 different sets of operating parameters)

Support for a group-paging function (up to 40 groups)

Supports directory search

Supports remote diagnostics

Software control for all operating parameters

Software control for speaker volume

Software control for LCD display contrast

Supports Interactive Paging Terminal access via RS-232 or modem

Supports automatic telephone dialing

Supports automatic log-on

Supports automatic transfer of pages

SECTION 1

INTRODUCTION

1.1 ABOUT THIS MANUAL

This manual was written for high-level users (i.e., system manager, system planner, or field service engineer).

1.2 CONTENTS SUMMARY

This manual is divided into the four sections listed below:

Section 1, INTRODUCTION: This section presents general information about the AlphaMate II and its use.

Section 2, THEORY OF OPERATION: This section presents the theory of operation of the AlphaMate II and the interface requirements for communicating with other equipment.

Section 3, SERVICEING INFORMATION: This section describes the physical construction, troubleshooting, and cabling of the AlphaMate II.

Section 4, PARTS LIST, SCHEMATIC DIAGRAMS AND PC BOARD LAYOUTS: This section contains the parts list, supporting diagrams, and schematics needed to service the AlphaMate II.

1.3 GENERAL INFORMATION

AlphaMate II is an integrated alphanumeric paging entry terminal with built in automatic telephone dialer and modem. It has a standard typewriter-like keyboard that has tactile feedback. The LCD display has a capacity of 80 characters presented on two lines. AlphaMate II has a dedicated parallel printer connector, an RS232-C serial port, two RJ11 connectors (phone and line) and a 7.5 VDC power jack.

The automatic telephone dialer supports on-hook dialing. The dialer has a directory of up to 10 primary telephone numbers and each primary number is backed up by an alternate telephone number.

The AlphaMate II will act as an interactive terminal when communicating with a paging terminal that supports interactive communications.

The AlphaMate II supports remote diagnostics and programming. Programming can be accomplished locally (by using the RS-232 connection) or remotely (by using the modem) through the use of another AlphaMate II or a terminal.

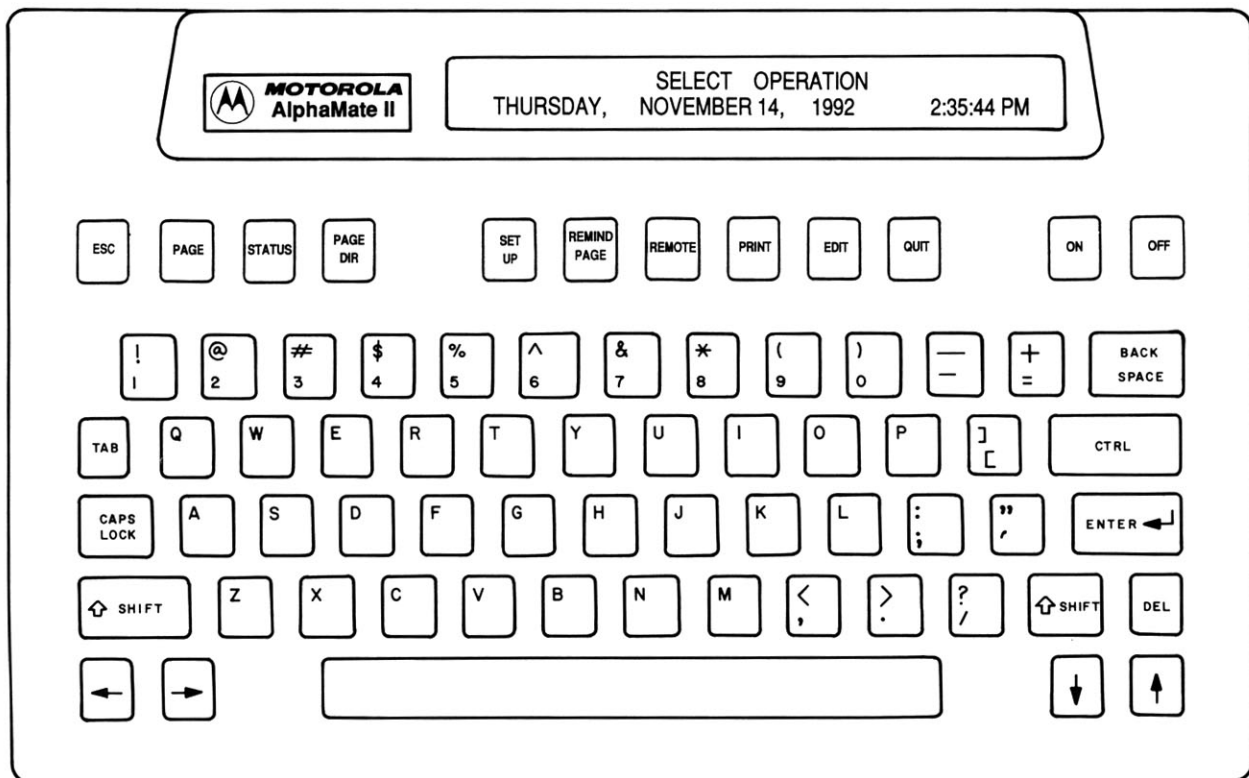


Figure 1-1 AlphaMate II

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SECTION 2

THEORY OF OPERATION

2.1 INTRODUCTION

This section provides a description of the major stages of the AlphaMate II. Each stage is represented by a block in the block diagram illustrated in figure 2-1. For individual circuit components and their relationships, refer to the schematics in section 4.

The major subsystems of the AlphaMate II are:

- **Microcontroller** - An 80C451 microcontroller controls all operations of the AlphaMate II.
- **RAM and EPROM** - 32 kbytes of battery-backed RAM and up to 256 kbytes of EPROM provide for storage of program data and firmware for the AlphaMate II. The EPROM is bank-switched.
- **Modem and Dial Access Arrangement** - Access to paging terminals is provided by a single-chip 1200 baud modem and a dial access arrangement that connects to the telephone line. An upgrade to 2400 baud is possible by changing to a 2400 baud modem chip.
- **Keyboard** - A keyboard with 69 keys is provided so that the user can enter data for sending pages.
- **Power Supply and Supervisor** - Power to the system is provided by a 5 volt linear regulator that regulates power supplied by the AC adapter. A microprocessor supervisor chip controls access to the 32 kbytes of battery-backed RAM and supplies power-fail and reset signals to the microcontroller.
- **RS-232 Interface** - An RS-232 interface is provided for connecting directly to a paging terminal instead of a phone line connection. The RS-232 port is also used for manufacturing-diagnostics, remote programming, AlphaMate-to-AlphaMate programming, and serial printing.
- **Parallel Printer Port** - A Centronics-compatible parallel printer port is provided for printing paging logs and directories to any parallel printer.
- **Liquid Crystal Display** - A 40-character by 2-line liquid crystal display is used to show information to the user.
- **Real-Time Clock** - A serial real-time clock chip is provided for system time logging and automatic paging. The time and date are also displayed when the system is idle.
- **Adapter** - Power for the system is supplied by a wall-mount AC adapter, 110Vac or 220Vac, with an output of 7.5 volts unregulated.

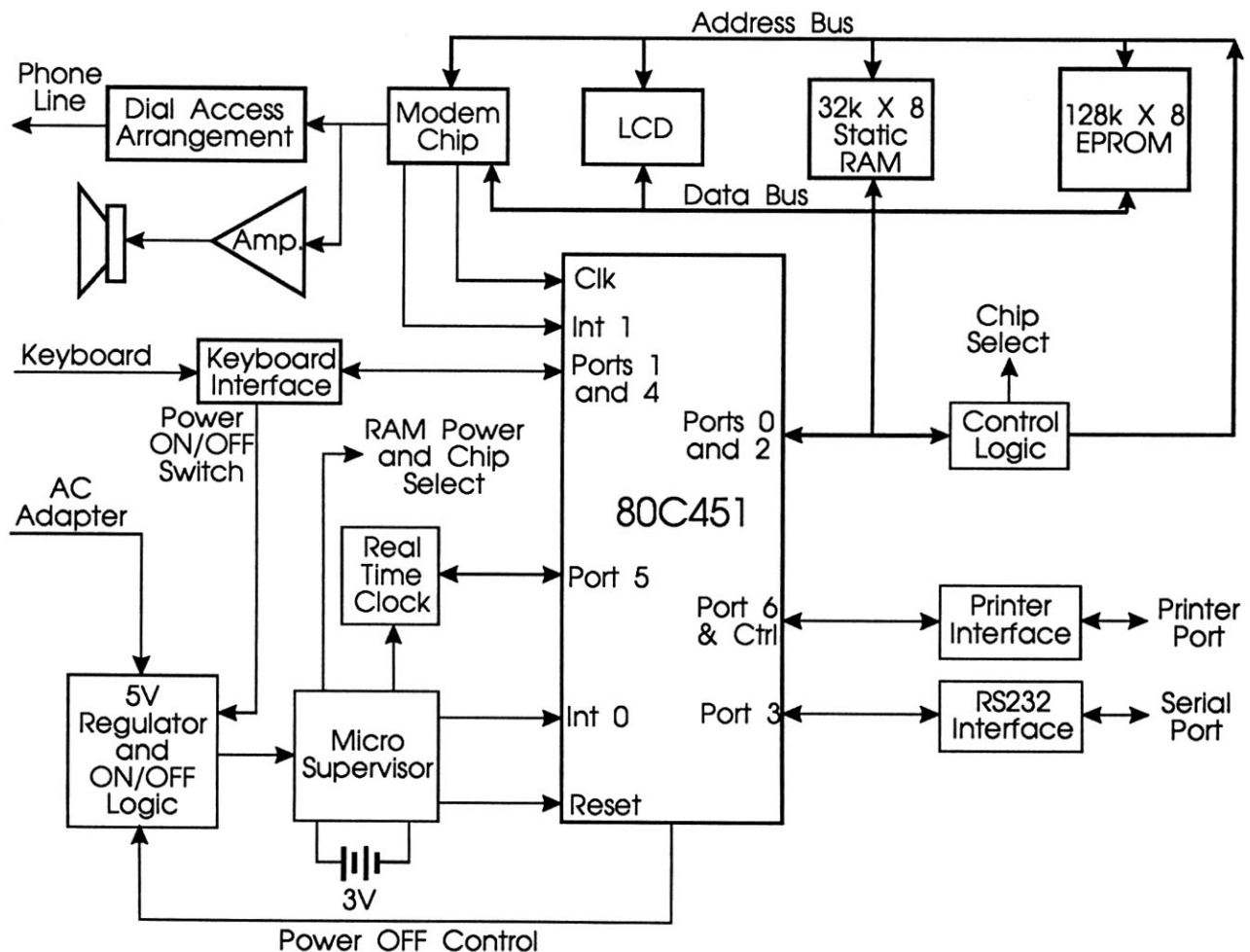


Figure 2-1: AlphaMate II Block Diagram

2.2 SUBSYSTEMS

2.2.1 Microcontroller

The AlphaMate II is controlled by an 80C451 microcontroller. The 80C451 has an 80C51-based architecture with seven 8-bit I/O ports, two 16-bit counters/timers, one serial port, two external interrupt pins, and 128 bytes of internal RAM. The 80C451 is used in microprocessor mode, so that two of the seven ports are used for communicating with external devices such as a RAM and an EPROM. Two 8-bit I/O ports are used for the external address and data buses; the remaining I/O ports are used to control various parts of the AlphaMate II (see table 2-1).

2.2.2 Port Assignments

The following paragraph describes how each I/O port is used:

Ports 0 and 2

The 80C451 communicates with external memory by using ports 0 and 2

Port 0 serves as the multiplexed address and data bus. This bus is de-multiplexed by means of an 74HC373 8-bit latch controlled by the ALE signal on the 80C451. The low-order address bits for the system are generated by this latch. Port 2 generates high-order address bits. The PSEN-signal provides access to external program memory stored in an external EPROM.

Ports 1 and 4

Port 1 is used for keyboard scanning forcing lines.
Port 4 is used for keyboard scanning detection lines.

Port 3

I/O port 3 is used for the serial port receive data RXD and transmit data TXD signals (for both the RS-232 port and the modem), the two timers, the two external interrupt pins, and read and write strobes for external memory. Read and write strobes are provided by RD- and WR- signals on Port 3.

Port 5

Port 5 is used for miscellaneous control and status signals. Two pins are used for a low-speed serial port to control the real-time clock and for the digital potentiometer used for contrast control.

The CNTRL signal serves as a row-select signal for the keyboard. The RI signal- serves as a ring indicator signal from the dial access arrangement.

The OFFHOOK signal is used to control the hook relay in the dial access arrangement.

The PWR signal is used to latch on power when the AlphaMate II is turned on.

FLASHPRG is used to enable the programming of the FLASH memory in units equipped with FLASH.

Port 6

Port 6 is used as the data port for the parallel printer port.

The four Port-6 control lines are also used by the parallel printer port.

Table 2-1: Microcontroller 80C451 Pin Assignments

Signal Name	Port Pins	Description
AD0-7	P0	Multiplexed data and low-order address buses
KSFRCO-6	P1,,0-6	Keyboard scanning forcing lines
PPPBUSY	P1.7	Busy input form printer port, for polling
A8-15	P2	High-order address bus
RXD	P3.0	Serial port receive data
TXD	P3.1	Serial port transmit data
PFINT	P3.2	Power fail interrupt
MDINT	P3.3	Modem interrupt
RTS	P3.4	Ready to Send to RS-232 port
CTS	P3.5	Clear to Send from RS-232 port
WR-	P3.6	External data memory write strobe
RD-	P3.7	External data memory read strobe
KSDET0-7	P4	Keyboard scanning detection lines
CNTRL	P5.0	Row select key for the keyboard
RI-	P5.1	Ring indication from DAA
OFFHOOK-	P5.2	Hook relay control for DAA
PWR-	P5.3	Power ON latch control
WDT-	P5.4	Watchdog timer strobe
FLASHPRG	P5.5	FLASH memory program enable
SDATA	P5.6	Serial data for real-time clock and digital pot
SCLK	P5.7	Serial clock for real-time clock and digital pot
PPPD0-7	P6	Parallel printer port data output
PPPSTB	BFLAG	Parallel printer port STROBE-output
PPPACK	ODS-	Parallel printer port ACKNOWLEDGE- input

Signal Name	Port Pins	Description
PPPRST	AFLAG	Parallel printer port RESET output
PPPBUSY	IDS-	Parallel printer port BUSY input

2.2.3 Memory Map

The external data memory map is shown in Table 2-2 below. Note that the 80C451 has separate spaces for data and for program. Only the data space is shown here; the program space is fully occupied by the EPROM.

The data space is decoded by using a programmable logic device.

Table 2-2: Memory Map

Address Range	Chip Select	Device
0000 - 7FFFH	RAMCS0-	Battery Backed Static RAM, 32k bytes
8000 - FDFEH	RAMCS1	Battery Backed Static RAM, 32 bytes (optional)
FE00 - FE7FH	MODEMCS-	Modem chip
FE80 - FEFFH	LCDE	Liquid Crystal Display
FF00 - FF80H	ALTCH-	Addressable Latch

2.2.4 UART

The Universal Asynchronous Receiver/Transmitter on the 80C451 I/O Port 3 is used for the RS-232 port and the modem. Timer 1 is used as the baud rate generator for the UART. The UART can be programmed for various bit rates (300 - 19,200 bps) and character sizes (7- or 8-bit data, 1 or 2 stop bits).

Timer pins T0 and T1 on I/O port 3 are not used; these pins serve as the CTS (Clear to Send) and RTS (Request to Send) signals for the serial port. These pins are under software control.

2.2.5 Timers

The 80C451 has two internal 16-bit timers in I/O Port 3. Timer 0 is used as a system timer which interrupts the microcontroller every 5 milliseconds, so that tasks like decoding the keyboard and polling various I/O pins are accomplished. Timer 1 is used as a baud-rate generator for the UART and is not programmed to interrupt the microcontroller. The timer input pins T0 and T1 on Port 3 are used for general-purpose I/O; they are not be used by the timers.

2.2.6 RAM and EPROM

The AlphaMate II contains 32 kbytes of battery-backed RAM for data storage and either 128 k or 256 kbytes of EPROM for firmware storage. Access to the 32 kbyte static RAM is controlled by the microprocessor supervisor chip, which controls the CE- pin on the static RAM to prevent writing to the device during power up and power down cycles. The microprocessor supervisor also switches power to the static RAM between VCC and the backup battery voltage VBATT.

A 128k byte EPROM is used for storage of the firmware for the AlphaMate II. This EPROM is upgradeable to a 256 kbyte EPROM for future enhancements to the AlphaMate II. The EPROM is bank-switched.

The bottom 32 kbytes (0-7FFFh) is always accessible to the microcontroller; the top 32 kbytes (8000-FFFFh) is bank-switched. If a 128 kbyte EPROM is used, three 32k byte banks are available; if a 256 kbyte EPROM is used, seven 32 kbyte banks are available. A bank is selected using the addressable latch. The EPROM device also contains diagnostics for manufacturing.

If alterable program memory is required, an AT29C010 (128 kbyte) or AT29C020 (256 kbyte) FLASH memory can be used instead of an EPROM (see table 2-3).

In order to program the FLASH memory, the appropriate bank is selected and the FLASHPRG pin is set to 0. Note that only the currently selected bank located at 8000-FFFFh can be programmed. The FLASH addresses from 0-7FFFh cannot be programmed. The FLASH bank must be relocated into the XDATA segment of the 80C451 to be programmed. This action is controlled by the FLASHPRG signal. When low, the FLASH addresses in the current bank are relocated into the XDATA segment

Table 2-3: RAM and EPROM Addresses

Bank Bits*	EPROM Address	Comments
000	00000-07FFFH	Do not use this setting
001	08000-0FFFFH	
010	10000-17FFFH	
011	18000-1FFFFH	
100	20000-27FFFH	Only with 256k EPROM
101	28000-2FFFFH	Only with 256k EPROM
110	30000-37FFFH	Only with 256k EPROM
111	38000-3FFFFH	Only with 256k EPROM

*Bank Address Bits BK2, BK1, and BK0

2.2.7 Modem and Dial Access Arrangement

This section describes the 1200-baud modem and its connection to the telephone line via the Dial Access Arrangement (DAA).

2.2.7.1 1200 Baud Modem

The AlphaMate II uses a 1200-baud single-chip modem (SSI 73K222L) to communicate with paging systems. The major features of this single-chip modem are:

- Bell 212A and 103 compatible;
- CCITT V.22 and V.21 compatible;
- Interfaces directly with 80C451;
- Call progress detection (busy, ringback, dial tone);
- DTMF and guard tone generation;
- Test modes include Analog Loopback (ALB), Digital Loopback (DL), Remote Digital;
- Loopback (RDL): mark, space, and alternating bit pattern generators;
- Single 5-volt supply.

Using the 73K222L part allows easy upgrade to 2400-baud (V.22bis) by simply replacing it with the 2400-baud single-chip (73K224L) modem.

The serial port on the 80C451 is shared by the modem chip and the RS-232 port. This design also allows direct access to the modem via the RS-232 port for testing the modem during manufacturing and field service. Note that this arrangement means that it's not possible to use the serial port for functions that require both the modem and the serial port to perform separate functions.

2.2.7.2 Hybrid Circuit

The hybrid circuit converts the two-wire interface to the telephone line into separate transmit and receive channels for the modem chip.

The hybrid circuit operates with the single 5-volt supply. The op-amps are biased to operate around 2.5 volts. This function is accomplished by using a Texas Instruments TLE2426 Rail Splitter, which provides a virtual ground at VCC/2. An additional op-amp is used to invert the transmitted signal so that the secondary of the transformer is driven differentially.

This circuit configuration doubles the voltage swing at the transformer, which ensures sufficient drive to the telephone line.

Because of the limited supply-voltage range, special op-amps are required in the hybrid circuit. An LMC660AIM quad op-amp is used because of its wide output voltage range when used with a single 5V supply, and its specifications for operation with a 600-ohm load.

2.2.7.3 Telephone Interface (USA)

The AlphaMate II is connected to the telephone line by an RJ11 telephone jack. Tip and ring pins from the RJ11 are then connected to the modem by using the dial access arrangement. Two positive coefficient resistors are used for protection against long-term surge voltages, and a surge

suppressor for protection against large, short time surges on the telephone line from lightning strikes. A Midcom 671-8001 transformer is used to isolate the modem from the telephone line. An Aromat DS2YE-S-DC5V relay serves as the hook relay to be used for connection to the telephone line and for pulse dialing. This relay also has low power requirements. A 4N35T optocoupler will be used for ring detection.

Table 2-4 lists the signal names and pins for connecting the AlphaMate II to a TELCO line jack.

Note:
The telephone cable is included with AlphaMate II.

Table 2-4: Telephone Cable Pin-Out Information

Signal Name	RJ-11	RJ-11
Tip	3	4
Ring	4	3

2.2.7.4 Telephone Line Interface (Asia)

This paragraph explains the differences between the US dial access arrangement and the International dial access arrangement. The primary differences are:

The transformer and relay must have higher insulation voltage ratings of 3750V. A Midcom 671-8238 transformer will be used.

Echo Return Loss (ERL) requirements are much more stringent, requiring use of a "dry" transformer and an electronic holding coil to pass the line current.

2.2.7.5 Speaker and Amplifier

An LM386 audio amplifier is used to amplify the modem signal and send it to a speaker so that the user can get some feedback about the connect state of the modem. The speaker volume is controlled by a Xicor X9313WS E@T2POT digital potentiometer under software control. The digital potentiometer is connected to the 80C451 by means of two I/O pins that serve as a software controlled serial interface.

2.2.8 Addressable Latch

An MC74HC259DW 8-bit addressable latch is used to generate extra control signals for the AlphaMate II. These signals are shown in the table below.

2.2.9 Keyboard Interface

The keyboard interfaces directly to the 80C451 micro-controller through ports 1 and 4. Port 1 serves as the forcing lines for scanning the keyboard, since this port has open-drain outputs. Port 4 serves as the sense lines for scanning the keyboard. Two 74HC157 multiplexers are used to multiplex the 14 rows from the keyboard into the 8

pins of I/O port 4. An additional I/O pin from port 5 is used to select the odd- or even-numbered rows.

2.2.9.1 TabKeyboard

The keyboard for the AlphaMate II has 69 keys, of which 68 are contained in a 6-by-14 matrix. The ON switch is entirely separate from the rest of the switches.

The 7 column lines of the keyboard are connected directly to the keyboard forcing lines KSFR6-0 on the microcontroller. The 14 rows of the keyboard are connected to the microcontroller through two 74HC157 2-to-1 multiplexers. The signal CNTRL on port 5 of the microcontroller determines which set of rows is connected to the keyboard-sensing lines KDET7-0. If CNTRL is low, the odd-numbered rows are connected; if high, the even-numbered rows are connected.

2.2.9.2 Keyboard Scanning

Keyboard-scanning is the operation that determines if any keys in the keyboard are pressed. The keyboard has 8 forcing lines and 16 detection lines (only 14 are used), along with the CNTRL 11 signal which determines which set of 8 detection lines are sent to the microcontroller. The main portion of the keyboard is arranged in an 8-by-14 matrix. Each of the detection lines is pulled up to VCC by a 10k Ohm resistor. The 8 forcing lines are driven by open-drain outputs in port 1 of the 80C451. To scan the keyboard, the 8 forcing lines are set to 1 (open drain output inactive), and each of the forcing lines is individually set to zero while scanning the 14 detection lines to see if any switches are pressed. Only the right SHIFT, left SHIFT and CTRL keys are allowed to be pressed simultaneously with other keys.

2.2.9.3 ON key

The ON key is entirely separate from the keyboard switch matrix.

The ON switch is used to power up the unit by temporarily grounding the gate of the input P-channel MOSFET, thus turning on the FET long enough for the microcontroller to latch on the MOSFET by grounding the I/O pin connected to the gate of the MOSFET.

2.2.9.4 Keyboard Connectors

The keyboard is attached to the printed circuit board by means of two ZIF connectors. The column connector is a Molex 39-51-3094 connector; the row connector is a Molex 39-51-3164 connector.

2.2.10 Power Supply and μ P Supervisor

This section describes the circuits that provide power to the AlphaMate II. A 5V linear regulator is used to regulate the incoming unregulated power from an AC adapter. A microprocessor supervisor chip monitors the input voltage and supplies reset and power-fail signals to the microcontroller. The supervisor chip also provides battery backup power for the 32 kbyte static RAM.

2.2.10.1 Linear Regulator

Input power to the AlphaMate II is supplied by an external AC adapter that supplies unregulated power of 7.5 volts at 250 mA. A TL750M05CKC 5-volt linear regulator is used to regulate the voltage to 5 volts for use in the AlphaMate II. This linear regulator features low dropout voltage of 0.6 volts and low quiescent power.

2.2.10.2 AC Adapter

Power for the AlphaMate II is supplied by an unregulated, filtered AC adapter with a nominal output voltage of 7.5V and a current rating of 250 mA. The AC adapters are wall-mounted and operate either at 110 Vac, 60 Hz or at 220 Vac, 50 Hz.

2.2.10.3 Microprocessor Supervisor

A Maxim MAX691 microprocessor supervisor chip is used to monitor power to the AlphaMate II, and to provide other supervisory functions to the microcontroller. These functions are:

- Reset output during power-up, power-down, and brown-out conditions;
- Battery backup switchover for static RAM;
- Watchdog timer that provides a reset pulse if the timer has not been toggled within a specified time;
- Threshold detector for power-fail warning;
- Write-protection of static RAM during power-up, power-down and brown-out conditions;
- Power-fail interrupt signal.

A 3-volt lithium battery is used as backup power for the static RAM and the real-time clock. The MAX691 provides switching from 5 V system power to 3 V battery power for maintaining the contents of the static RAM when power is off. The supervisor also protects the static RAM from being corrupted during power-up and power-down.

2.2.11 RS-232 Interface

An RS-232 interface is provided for:

- Direct access to paging terminals without using the telephone line;
- Manufacturing diagnostics control;
- Remote programming from an external terminal;
- AlphaMate-to-AlphaMate programming;
- Printing to a serial printer.

2.2.11.1 Serial Port

The RS-232 interface is provided by the 80C451 serial port and two I/O pins, which provide RTS and CTS signals. One of the timers on the 80C451 will be programmed for standard bit rates, including 300, 1200, 2400, 4800, and 9600 bps. The serial port on the 80C451 is shared with the modem, so actions that require both the modem plus the serial port to perform separate functions are possible.

2.2.11.2 RS-232 Transmitters and Receivers

A 5-volt RS-232 driver/receiver (Maxim MAX222) is used to convert TTL-level signals from the 80C451 to RS-232 voltage levels.

The Maxim MAX222 has internal voltage doublers and voltage inverters to generate the RS-232 level voltages; and it has two transmitters and two receivers. The part also has a SHUTDOWN pin used to disable outputs and to turn off the internal DC/DC converters. The SHUTDOWN pin is used so that the receiver outputs from the part to the 80C451 can be disabled when receiving data from the modem.

2.2.11.3 Protection Circuits

Protection circuits are used to protect the interface from transients that may be generated on the printer-port signal lines.

2.2.12 Liquid Crystal Display

A 40-character by 2-line Liquid Crystal Display (LCD) provides information to the user about paging and the AlphaMate II. The LCD appears to the microcontroller as a memory-mapped device on the data bus.

The contrast of the LCD is controlled by a Xicor X9313WS E_{ET}2POT digital potentiometer under software control. The digital potentiometer is connected to the 80C451 with two I/O pins that serve as a software-controlled interface.

2.2.13 Real-Time Clock

A Dallas Semiconductor DS1202S serial Real-Time Clock chip is used to supply timekeeping functions for the AlphaMate II. The real-time clock counts seconds, minutes, hours, date of the month, month, day of the week, and the year, with leap-year compensation. It communicates with the microcontroller over a three-wire serial interface, and it uses less than 1 mW of power during standby operation.

SECTION 3

SERVICING INFORMATION

3.1 DISASSEMBLY INSTRUCTIONS

3.1.1 Opening the AlphaMate

To open the AlphaMate, follow the steps listed below (see figure 3-1):

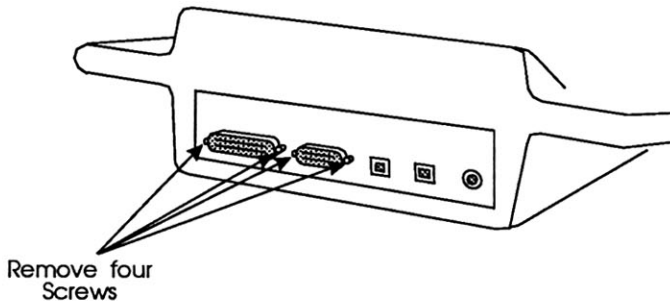


Figure 3-1: Back-Panel Screws

Step 1 Remove the four screws from the back panel.

Step 2 Place the AlphaMate upside-down on a work table (see figure 3-2) and insert the T-handle tool (part number DNP-12511, supplied with the AlphaMate) as illustrated in the figure (the tool must be inserted as far as it will go into the smaller outermost slot).

Step 3 Turn the T-handle tool counter-clockwise (as illustrated) to unlock the left-side fastener.

Step 4 While holding the fastener open, push the T-handle tool to open the case. The case will open at point A (see figure 3-3).

Step 5 Use the T-handle tool to open the right side of the case (the tool must be inserted as far as it will go into the smaller outermost slot). Turn the tool clockwise to unfasten the lock (see figure 3-4).

Step 6 While holding the fastener open, pivot the T-handle tool to open the case. The case will open at point B (see figure 3-5).

Step 7 After the case is unlocked and opened as illustrated in figure 3-5, the top and bottom can be separated. When separating the case, care must be exercised so that ribbon cables and connectors are not damaged. See figure 3-6 for an exploded view of the AlphaMate.

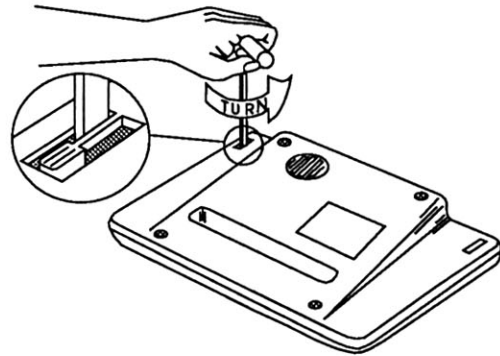


Figure 3-2: Unlocking Case (left side)

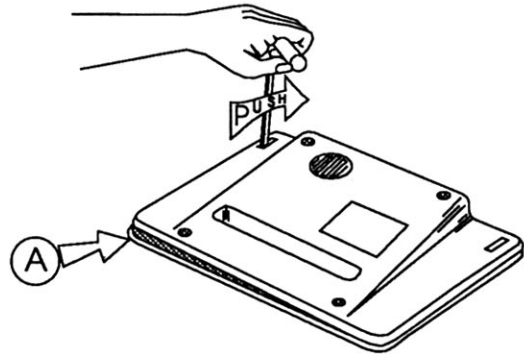


Figure 3-3: Opening Case (left side)

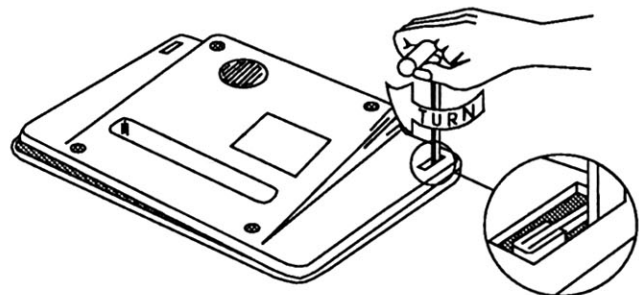


Figure 3-4: Unlocking Case (right side)

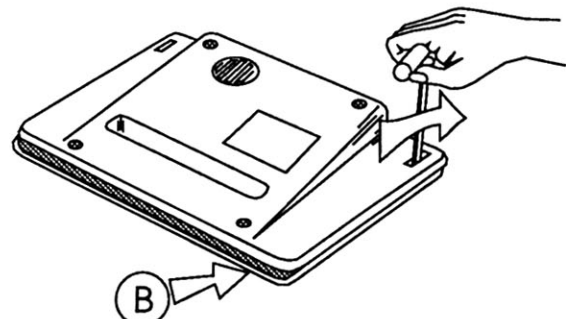


Figure 3-5: Opening Case (right side)

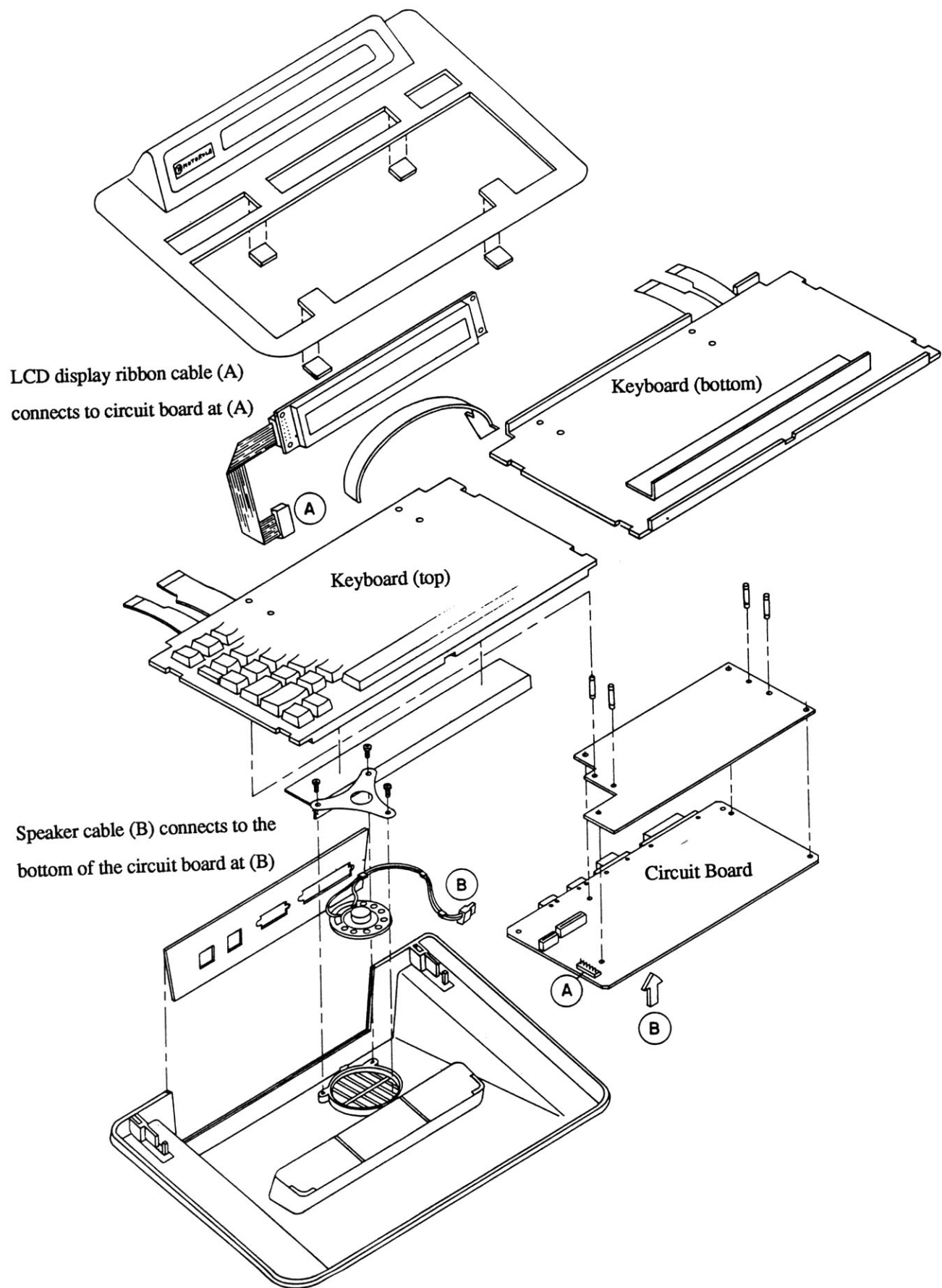


Figure 3-6 AlphaMate Exploded View

3.2 TROUBLESHOOTING

Servicing of AlphaMate II requires localizing the malfunctioning circuit before the defective component can be isolated and replaced. Since localizing and isolating a defective component constitutes the most time-consuming part of troubleshooting, a thorough understanding of the circuits involved will aid the technician in performing timely and efficient servicing.

The technician must know how one function affects another; be familiar with the overall operation, and be familiar with the procedures necessary to place the AlphaMate II back in operation.

The AlphaMate II functional block diagram, schematic diagrams, and circuit board diagrams provide valuable information for troubleshooting purposes. The functional block diagram provides signal-flow information in a simplified format, and the schematic diagrams provide the detailed circuitry and the waveforms required for isolating malfunctioning components.

NOTE

Individual piecparts, unless Motorola part numbers are listed, are not available from Motorola. If your AlphaMate requires servicing beyond your capability, the entire circuit board can be replaced. Contact the Motorola Hi-Tech Service Center for board availability.

CAUTION

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Discard used battery according to the manufacturer's instructions.

3.3 TROUBLESHOOTING HINTS

3.3.1 Phone Line Requirements

A 2-wire analog circuit is required. The AlphaMate will not work with multi-line or digital telephone circuits.

3.3.2 Initial Connect Problems

(1) Symptom: AlphaMate II will not power-up

Possible Cause:

1. Power supply not plugged into source.
2. Power supply not plugged into unit.
3. Power supply not working.
4. Power ON/OFF circuit in AlphaMate II defective.

(2) Symptom: Unit will not seize phone line

Possible Cause:

1. Phone line not connected.
2. Phone cable defective.
3. Modem defective.

(3) Symptom: Unit will not communicate with printer.

Possible Cause:

1. Printer not turned on.
2. Printer cable not connected.
3. AlphaMate II port not configured to match printer specifications. Refer to printer manual and AlphaMate II Set Up.

(4) Symptom: Unit fails one or more self-tests.

Possible Cause: See paragraph 3.4 below.

3.4 SELF-TESTS AND DIAGNOSTICS

Hardware diagnostics are used to diagnose problems with the AlphaMate II hardware during manufacture and to aid repair in the field. Low-level control routines are used by the hardware diagnostics and the human-interface routines to control the AlphaMate II hardware.

The interrupt service routines are used for servicing interrupts from the hardware. The human-interface firmware allows the user to enter pages, edit the paging directory, and carry out other tasks necessary for sending pages.

3.4.1 Hardware Diagnostics

This section describes the hardware diagnostics of the AlphaMate II. These diagnostics are used in manufacturing and field service to diagnose and repair failures. These tests use the low-level device drivers and interrupt service routines to perform the tests.

Hardware diagnostics are divided into two categories: Powerup Self-Test and Manufacturing Diagnostics. The powerup self-test is performed each time the AlphaMate II is turned on; this self-test is a subset of the manufacturing diagnostics. The manufacturing diagnostics may be run under control of the keyboard, the serial port, or the modem. In all three cases, the commands and functions performed are identical.

Each of the tests described below can be performed individually or in functional groups, and tests that require an operator or that change configurations or memory can be individually enabled or disabled.

3.4.2 Microcontroller Diagnostics

The microcontroller diagnostics are used to test the operation and performance of the 80C451 microcontroller and its internal RAM. These tests are performed at powerup. The microcontroller diagnostics consist of an Internal RAM Test. This test verifies that the internal 128 bytes of RAM are functional.

3.4.3 Memory Diagnostics

The memory diagnostics are used to test and verify the static battery-backed RAM and the EPROM. Several tests make up the memory diagnostics:

- **Non-destructive Static-RAM Test.** This test verifies that each location in the static RAM can be read and written, using four different values: 00h, 55h, AAh, and

FFh. Each location is saved before the test is performed so that contents of the memory will be unchanged after the test is complete. This test is performed during powerup self test.

- **Destructive Static-RAM Test.** This test consists of several subsets that verify each location in the static RAM and also confirm that each location can be uniquely addressed. This test also checks the static RAM for pattern failures. The contents of the RAM are changed during this test, so any data stored in the AlphaMate is lost.
- **RAM Non-Volatility Test.** This test verifies that the static RAM is not affected when power is turned off. This test is performed by calculating a CRC checksum on the entire static RAM, turning off the power to the unit, waiting a short period of time, and powering the unit back up. This test requires that an operator turn the unit back on after the specified period of time.
- **EPROM CRC Checksum Test.** This test verifies the EPROM contents by performing a CRC checksum over the entire contents of the EPROM and comparing the checksum with the known value stored at the end of the EPROM. This test is performed during powerup self-test.
- **Modem and DAA Diagnostics.** The modem and DAA diagnostics verify proper operation of the modem and the dial access arrangement. The modem and DAA diagnostics consist of:
 - **Digital Loopback Test.** The Digital Loopback Test is used to verify that the modem can send and receive data to and from the microcontroller.
 - **Analog Loopback Test.** The Analog Loopback Test is used to verify that the transmitter and receiver of the modem are functional by looping the output of the modem's transmitter to its receiver and verifying that the modem can pass data.
- **Remote Digital Loopback Test.** The Remote Digital Loopback Test is used to verify that the modem can send and receive data properly to another modem over the telephone network or over a line simulator. This test causes the remote modem to loopback data received to its own transmitter and send the data back to the AlphaMate II. This test is most useful for verifying modem performance in the field.
- **Bit Error Rate (BER) Test.** The Bit Error Rate Test verifies that the modem hardware and software are functioning properly by connecting the modem with another modem over a telephone line or through a line simulator. When using a line simulator, different conditions may be simulated to verify that the modem can transmit and receive data properly. The AlphaMate II generates the CCITT V.54 511 data pattern for use with this test. This test is most useful for verifying performance in the lab and factory.

3.4.4 Keyboard Diagnostics

The keyboard diagnostics verify proper operation of the keyboard. These tests consist of:

- **ON-OFF Test.** This test verifies that the AlphaMate can be turned on and off by using the ON and OFF keys. An operator is required for this test.
- **Key Test.** This test verifies that each of the keys on the keyboard is functional. The display shows a character representing each key. When the key is pressed, the character for that key is removed. When the display is blank, the test is complete. This test requires an operator.

3.4.5 Power Supply and μ P Supervisor Diagnostics.

The Power Supply and Microprocessor Supervisor diagnostics are used to verify proper operation of the power supply to the AlphaMate II. These tests consist of:

- **Watchdog Timer Test:** This test is used to verify that the watchdog timer can reset the AlphaMate II.
- **ON-OFF Test:** This test is used to verify that software can turn off power to the AlphaMate II. An operator is required to turn the power back on after this test.
- **Power Failure Test:** This test is used to verify that the power fail detection circuit is operational. An operator is required to disconnect the AC adapter from the AlphaMate for this test.
- **Voltage Threshold Test:** This test is used to verify that the power-fail detection circuit threshold is correct. An external adjustable power supply and an operator are required for this test.

3.4.6 RS-232 Interface Diagnostics.

The RS-232 Interface Diagnostics are used to verify proper operation of the RS-232 serial port.

- **Loopback Test:** This test is used to verify that the RS-232 port can be used to send and receive data. A loopback connector must be attached to the 9-pin D connector for this test.
- **Speed Test:** This test is used to verify that the proper baud rates are being generated by enabling timer 1 interrupts and timing them by using timer 0.
- **Shutdown Test:** This test is used to verify that the RS-232 port drivers and receivers can be shut off so that the modem can be used.

3.4.7 Parallel Printer Port Diagnostics.

The Parallel Printer Port diagnostics verifies proper operation of the parallel printer port. A printer with a parallel port is required to run these tests.

- **Print Characters Test:** This test is used to verify that the parallel printer port can print characters to a printer.
- **Printer Timeout Test:** This test is used to verify that the parallel printer port can timeout when a printer is not attached or the printer is unpowered.

3.4.8 LCD Diagnostics

The LCD diagnostics verifies proper operation of the LCD. These diagnostics consist of:

- **Display Blanking Test:** This test is used to verify that the display can be cleared and no pixels are turned on. An operator is required to view the display for this test.
- **Display Pixel Test:** This test is used to verify that all of the pixels on the display can be turned on and off. An operator is required to view the display for this test.
- **Read/Write Data Test:** This test is used to verify that the display can be read from and written to by the microcontroller. This test also verifies that the command set for the LCD is functional. An operator is not required for this test.
- **Character Set Test:** This test is used to verify that the character set of the LCD can be displayed. An operator is required for this test.

3.4.9 Real-Time Clock Diagnostics

The Real-Time Clock diagnostics verifies proper operation of the real-time clock. These diagnostics consist of:

- **Real-Time Clock RAM Test.** This test is used to verify that the RAM in the real-time clock is functional. This is a non-destructive test; the RAM contents are restored at the end of the test.
- **Real-Time Clock Timing Test.** This test is used to verify that the clock is operational and that time-keeping is correct within the limits of the microcontroller clock. This is a non-destructive test; the time and date are not modified.
- **Real-Time Clock Functional Test.** This test is used to verify that the real-time clock functions (clock, calendar, RAM) are working properly. This is a destructive test; the time, date, and RAM contents are destroyed.

3.5 CABLING

3.5.1 RS-232 Connector

The RS232 connector is a male 9-pin D subminiature connector. The port is configured as Data Terminal Equipment (DTE), per EIA RS-232D.

Table 3-1 lists the signal names and pins for connecting the AlphaMate II (via RS-232 interface) to other devices:

- AlphaMate to AlphaMate connection.
- Connection to a paging system.
- Connection to a terminal or an IBM compatible computer.

Note:
These cables are not included with AlphaMate II.

Table 3-1: RS232 Cable Pin-Out Information

Signal Name	9-pin D female to AlphaMate II	9-pin D connector to other equipment
RXD	2	3
TXD	3	2
CTS	8	7
RTS	7	8
Signal GND	5	5

3.5.2 Parallel Printer Port

A parallel printer port is provided to allow printing of paging logs and page directories. This printer port is Centronics-compatible, and uses a female 25 pin D subminiature connector (as on IBM PC compatible computers).

3.5.2.1 Parallel Port Signals

The following signals are generated or received by the parallel printer port:

Data lines D7-D0: These lines provide data to the printer.

STROBE- signal: This signal serves as the data available signal to the printer.

ACK- signal: This signal indicates that the printer received the data from the printer port.

BUSY signal: This signal indicates that the printer is busy and is unable to receive data from the printer port.

RESET signal: This signal causes the printer attached to the printer port to be reset to its power up state.

These signals are TTL compatible and are driven by 74LS244 outputs.

3.5.3 AlphaMate to People Finder Cable

Use the cable listed below (see table 3-2) when connecting AlphaMate and People Finder:

Table 3-2: AlphaMate to People Finder Cable Pin-Out

Signal Name	9-pin D female to to AlphaMate	25-pin male to People Finder
RXD	2	2
TXD	3	3
CTS	8	20
RTS	7	5, 6, 8
GND	5	7

Note:
Some additional signals may be provided on the cable; these will not be used by the AlphaMate II.

This cable is a standard parallel printer port cable used on IBM PC compatible computers.

3.5.4 AlphaMate to Page Bridge Cable

Use the cable listed below (see table 3-3) when connecting AlphaMate and People Finder:

Table 3-3: AlphaMate to Page Bridge Cable Pin-Out

Signal Name	9-pin D female to to AlphaMate	25-pin male to Page Bridge
RXD	2	3
TXD	3	2
CTS	8	20
RTS	7	5, 6, 8
GND	5	7

3.5.5 Parallel Port Connector

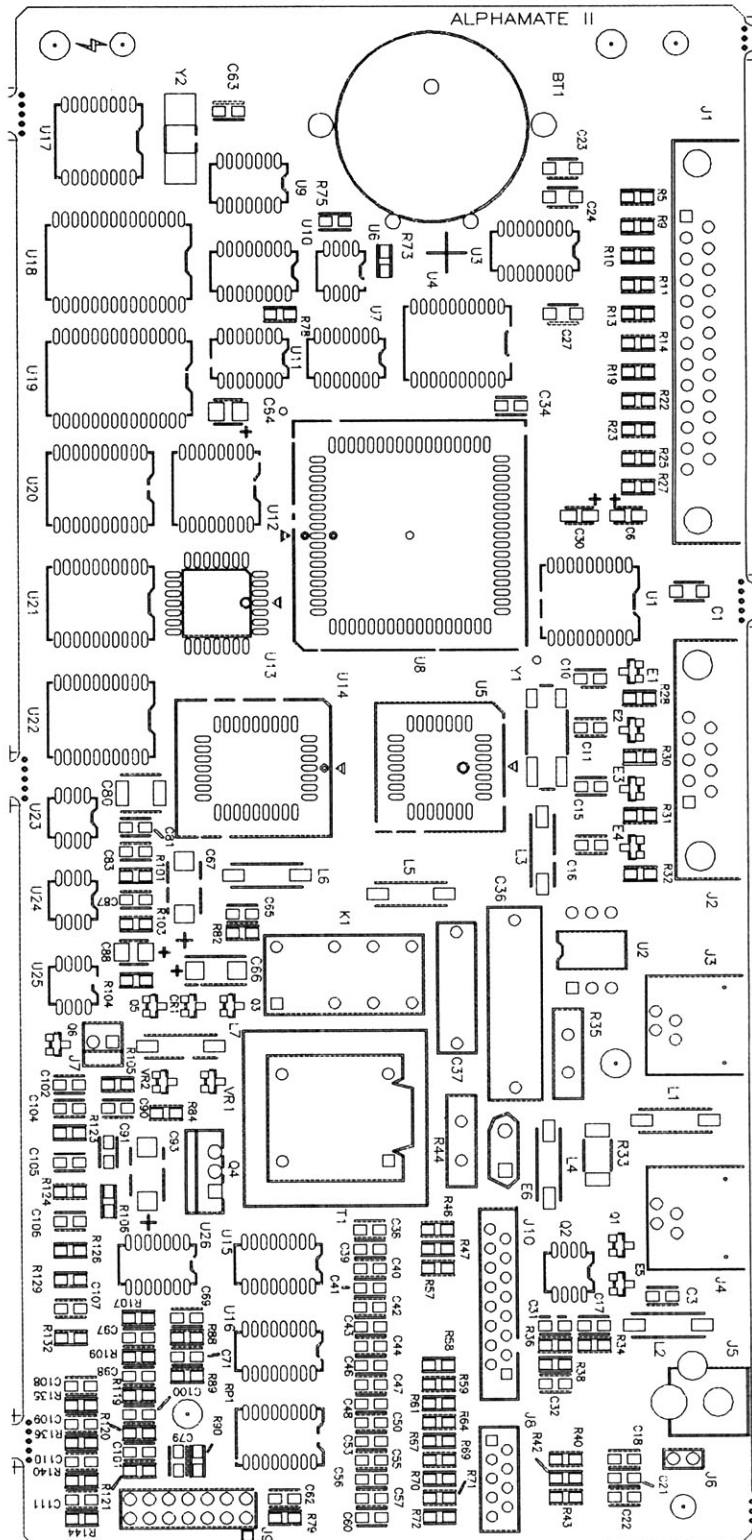
A female 25-pin D subminiature connector is used. The connector and pinouts are identical to those used on IBM PC compatible computers.

Table 3-4 lists the signal names and pin assignments for the cable that connects the AlphaMate II to a Centronics-compatible printer.

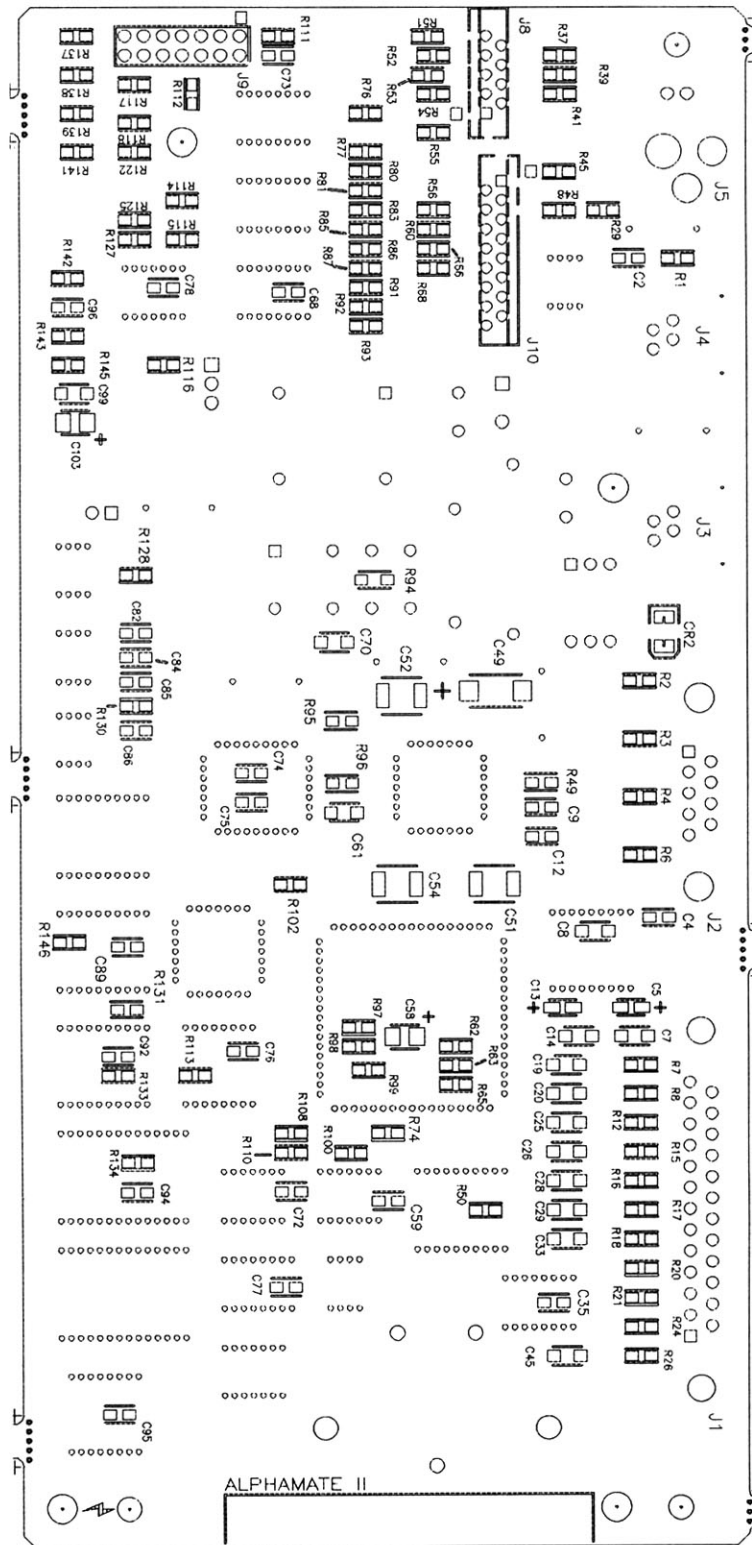
Table 3-4: Parallel Printer Port Pin-Out Information

Signal Name	25-pin male to AlphaMate	Amphenol 57-30360 to Printer
Strobe- (output)	1	1
D0+ (output)	2	2
D1+ (output)	3	3
D2+ (output)	4	4
D3+ (output)	5	5
D4+ (output)	6	6
D5+ (output)	7	7
D6+ (output)	8	8
D7+ (output)	9	9
Ack (input)	10	10
Busy+ (input)	11	11
Printer Reset+ (output)	16	16
Signal Ground	19 - 25	19 - 25
Signal Ground	18	-
Signal Ground	-	26 - 30, 33

SECTION 4
PARTS LIST, SCHEMATIC DIAGRAMS,
PC BOARD LAYOUT



AlphaMate II Main Corcuit Board Component Side Layout



AlphaMate II Main Corcuit Board Solder Side Layout

ALPHAMATE II - (MODEL # N1593A)
BOARD REVISION O - (KIT # NYN4545A)
PARTS LIST REVISION F

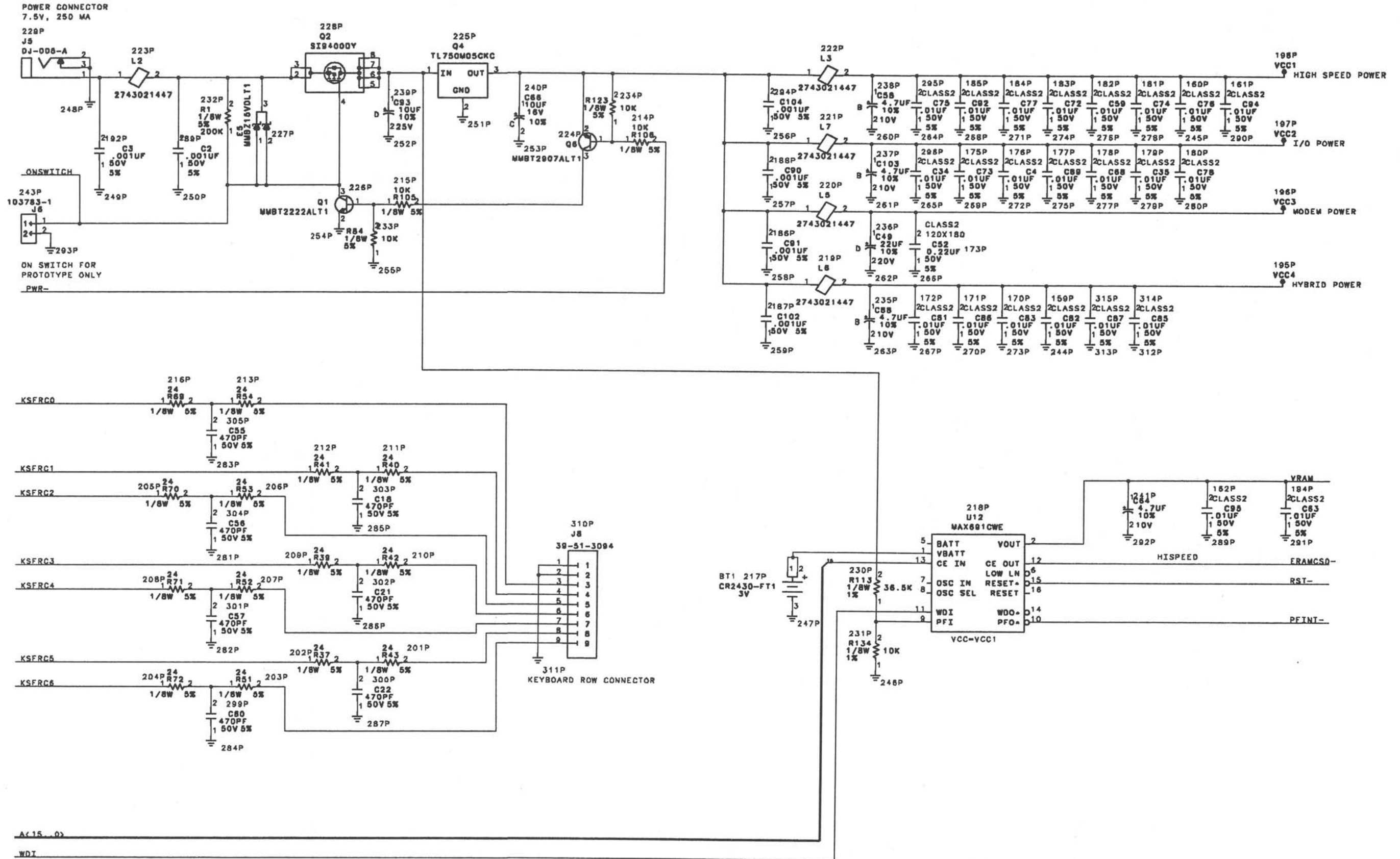
MOTOROLA P/N	DESCRIPTION	REFERENCE DESIGNATOR
SURFACE MOUNT COMPONENTS		
0660076A10	24 OHM 5%	R2-32, 34, 36-43, 45-48, 51-61, 64, 66-72, 76, 77, 79-81, 83, 85-93, 109, 111, 112, 114, 115, 117-122, 125, 135-141, 144
0660076A13	33 OHM 5%	R49, 63, 65, 74, 97, 99
0660076A33	220 OHM 5%	R50, 73, 100, 103, 131, 133
0660076A49	1K 5%	R98
0660076A64	4.3K 5%	R75
0660076A73	10K 5%	R62, 78, 84, 96, 101, 104-106, 123, 128, 146
0660076A81	22K 5%	R130
0660076B08	200K 5%	R1
0660076E41	470 1%	R143
0660076E61	3.3K 1%	R124
0660076E73	10K 1%	R134
0660076E80	20K 1%	R107, 116, 127, 129, 132, 142, 145
0660076H32	2M 10%	R95
0660076M01	0 OHMS 5%	R108
0660079G12	1.27K 1%	R126
0660079J27	17.8K 1%	R102
0660079J64	36.5K 1%	R113
0660079J66	37.4K 1%	R82
0660079Y67	560 OHM 10% 1/4W	R94
0662001B01	22K 5% 1W	R33
2113740A35	18PF 5%	C9
2113740A43	39PF 5%	C12
2113740A69	390PF 5%	C65
2113740A71	470PF 5%	C10, 11, 15-18, 21, 22, 31, 32, 38-44, 46-48, 50, 53, 55-57, 60, 62, 69, 71, 79, 97, 98, 100, 101, 108, 109-111
2113740A79	0.001UF 5%	C2, 3, 90, 91, 102, 104, 107
2113740B80	0.0022UF 5%	C19, 20, 23-29, 33, 45
2113741A37	0.0047UF 5%	C105
2113741A45	0.01UF 5%	C4, 34, 35, 59, 63, 68, 72-78, 81-87, 89, 92, 94, 95, 106
2113741A57	0.033UF 5%	C96
2113741B69	0.1UF 5%	C61, 70, 99
2113741D28	0.22UF 5%	C51, 52, 54, 80
2311049A13	4.7UF 10%	C58, 64, 88, 103
2311049A18	10UF 10% 16V	C66
2311049A19	10UF 10% 25V	C93
2311049A21	22UF 10%	C49
2311049A23	47UF 10%	C67
2311049A36	1UF 10%	C5, 6, 13, 30
0962000F23	SOCKET	
0962999F26	SOCKET	
5162001R06	25NS GAL	U13
5162848H35	1200 BAUD SINGLE- CHIP MODEM	U5
5162848L11	CMOS SINGLE-CHIP 8-BIT MICRO CTRL	U8

MOTOROLA P/N	DESCRIPTION	REFERENCE DESIGNATOR
2462000K07	FERRITE BEAD	L1-7
4813824A11	NPN TRANSISTOR, 40V, 0.6A SOT23	Q1, 5
4813824A21	PNP TRANSISTOR, 60V, 0.6A SOT23	Q3, 6
4813830A13	ZENER DIODE, 4.7V 5% @ 20MA, 350MW SOT23	VR1, 2
4813832C28	BIPOLAR ZENER, 15V (ESD PROTECTION) SOT23	E1-5
4813833C09	SIGNAL DIODE, 0.1A, 100V SOT23	CR1
4862001N09	LOGIC LEVEL P-CHANNEL MOSFET 8 PIN SOIC	Q2
4862825A02	RECTIFIER, 1.5A, 400V SOD87	CR2
4862818B05	11.0592 MHZ CRYSTAL	Y1
4862818B06	32.768 KHZ WATCH CRYSTAL	Y2
5113805A04	HEX INVERTER 14 PIN SOIC	U11
5113805A26	QUAD 3-ST NON INV BUFFER 14 PIN SOIC	U7
5113805A36	QUAD 2-IN NON INV MULTIPLEXER 16 PIN SOIC	U15, 16
5113805A57	OCT 3-ST NON INV BUS LN TRANSCVR 20 SOIC WIDE	U22
5113805A59	8 BIT DECODER OR LATCH 16 PIN SOIC	U10
5113805A62	OCT 3-ST NON INV TRANSPARENT LATCH 20 SOIC WIDE	U20
5113805A99	QUAD 2-INPUT AND 14 PIN SOIC	U9
5162848G36	OCT 3-ST BUFFER/LINE DRIVER	U4, 21
5162848H28	SERIAL TIMEKEEPING CHIP 16 SOIC WIDE	U17
5162848H29	MICRO MANAGER 16 SOIC WIDE	U12
5162848H30	ADV LOW POWER 5V DUAL EIA-232 DR/RC 18 SOIC WIDE	U1
5162848H32	CMOS QUAD OP AMP 14 PIN SOIC	U26
5162848H33	LOW VOLTAGE AUDIO POWER AMPLIFIER 8 PIN SOIC	U24
5162848H36	RAILSPLITTER VIRTUAL GND GENERATOR 8 PIN SOIC	U25
5162848K11	ULTRA LOW POWER 32KX8 SRAM 28 SOIC WIDE	U18
5162849K15	EEPOT (10K) 8 PIN SOIC	U23
5162849K21	EEPOT (1K) 8 PIN SOIC	U6
5162998S01	10K BUSSED RESISTOR NETWORK	RP1
8062941B02	ESD PROTECTION ARRAY 16 PIN SOIC	U3
8405996G01	PC BOARD	
	LEADED ELECTRICAL COMPONENTS	
0662080A05	PTC THERMISTOR	R35, 44
0862002Y01	FILM CAPACITOR, 0.0047UF, 1000V, 10%	C37
0862002Y02	FILM CAPACITOR, 0.47UF, 250V, 10%	C36
0962000F24	2MM DC POWER JACK	J5
0962000G01	MODULAR JACK, 6 POSITION, 4 FILLED	J3, 4
0962000G02	25 PIN D SUBMINIATURE CONN., FEMALE	J1
0962000G03	9 PIN ZIF CONNECTOR	J8
0962000G04	16 PIN ZIF CONNECTOR	J10
2562000M08	MODEM COUPLING TRANSFORMER	T1
2862000P13	9 PIN D SUBMINIATURE CONN., MALE	J2

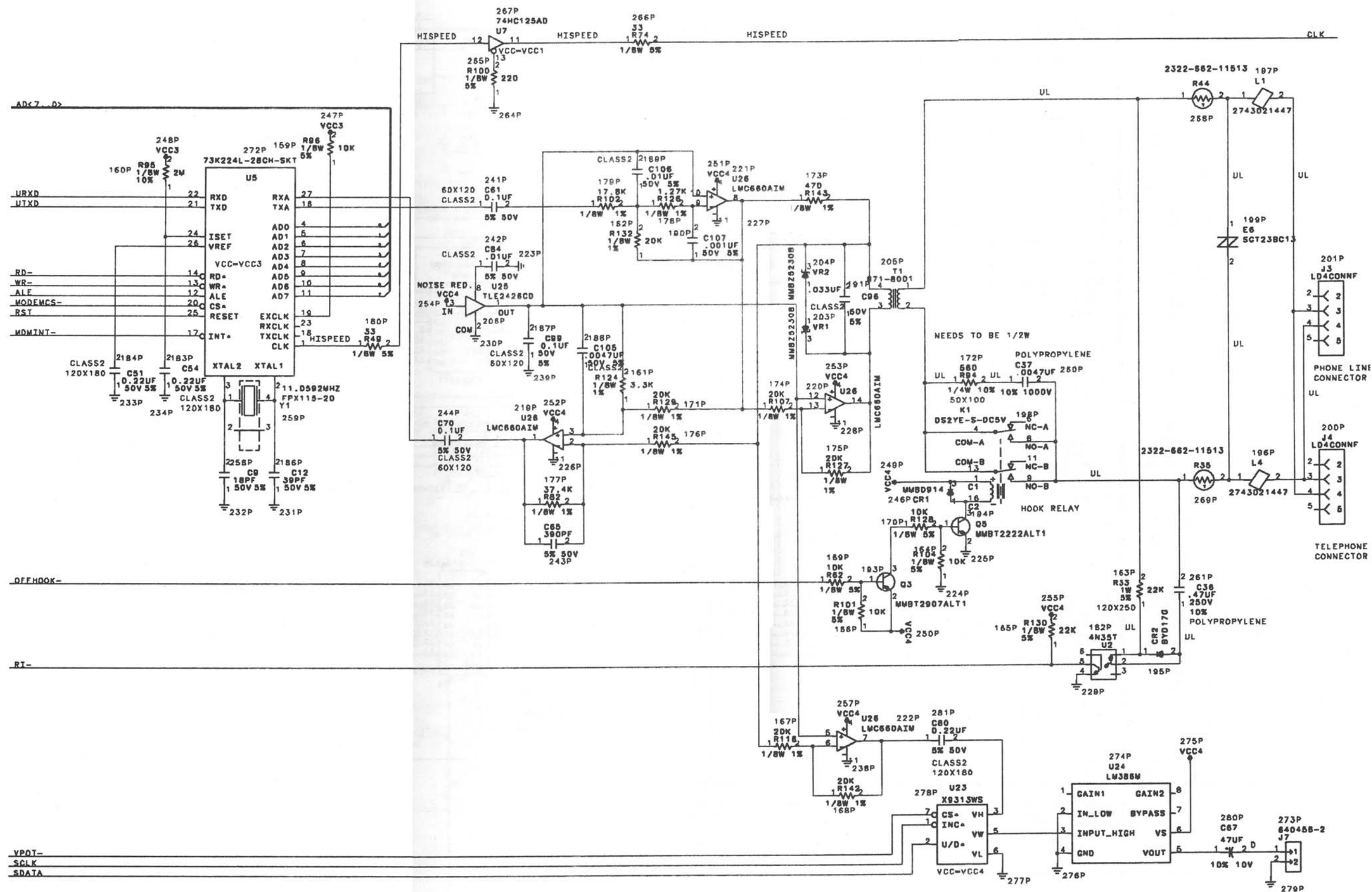
MOTOROLA P/N	DESCRIPTION	REFERENCE DESIGNATOR
2862626B11	2 PIN FRICTION LOCK HEADER	J7
2880001S14	14 PIN HEADER CONNECTOR, DOUBLE ROW	J9
5162848H34	5V LOW-DROPOUT VOLTAGE REGULATOR	Q4
5162849H02	OPTOISOLATOR	U2
6062000W02	3V LITHIUM BATTERY, 270MAH	BT1
7505045X03	PAD, SHOCK DAMPING (BATTERY) TO BE PLACED UNDER BATTERY	
8062002T02	SURGE SUPPRESSOR	E6
8062003F04	2 FORM C LOW-PROFILE RELAY	K1
	SOCKETED COMPONENTS	
5162001R06	25NS EEPROM	U13
5162848H35	1200 BAUD SINGLE-CHIP MODEM	U5
5162848L11	CMOS SINGLE-CHIP 8-BIT MICRO CONTRLR	U8
5162849K24	512KX8 CMOS EPROM, OTP	U14

MOTOROLA P/N	DESCRIPTION
	MODEL ASSEMBLY COMPONENTS
0105993N01	KEYBOARD ASSEMBLY
0162488A05	FST SPEAKER & CABLE ASSEMBLY
0162488A07	OPTREX LCD & CABLE ASSEMBLY
0311994A09	SCREW, THD. FORMING
0705962M01	BRACKET STIFFENER
1305996W01	APEXX LCD WINDOW & ESCUTCHEON
1505990N01	SECURITY PLASTICS TOP HOUSING
1505991N01	SECURITY PLASTICS BOTTOM HOUSING
2562601C02	ENSIGN CORP. 92043 AC ADAPTER
3005104G04	MEGASSEMBLY RJ11 CABLE
3362742A05	APEXX NAMEPLATE
4205974E01	RETAINER, SPEAKER
4305115G03	STANDOFF (METAL EXTERNAL)
4305960E01	STANDOFF, ALUMINUM SNAP-TOP
4762003E04	POST, SUPPORT-1/2" (PLASTIC INTERNAL)
5405008T08	SERIAL PLATE LABEL
5605990X01	CARTON
5605999W01	CARTON INSERT
5662875A03	BAG, BUBBLE WRAP
6405998V01	SUPPORT PLATE
6405999V01	REAR PANEL
7505045X02	PAD, SHOCK DAMPING (SPEAKER)
7505045X04	PAD, SHOCK DAMPING (LCD)
7505045X05	PAD, SHOCK DAMPING (TOP HOUSING)
7562003D01	(U-1) BUMPER

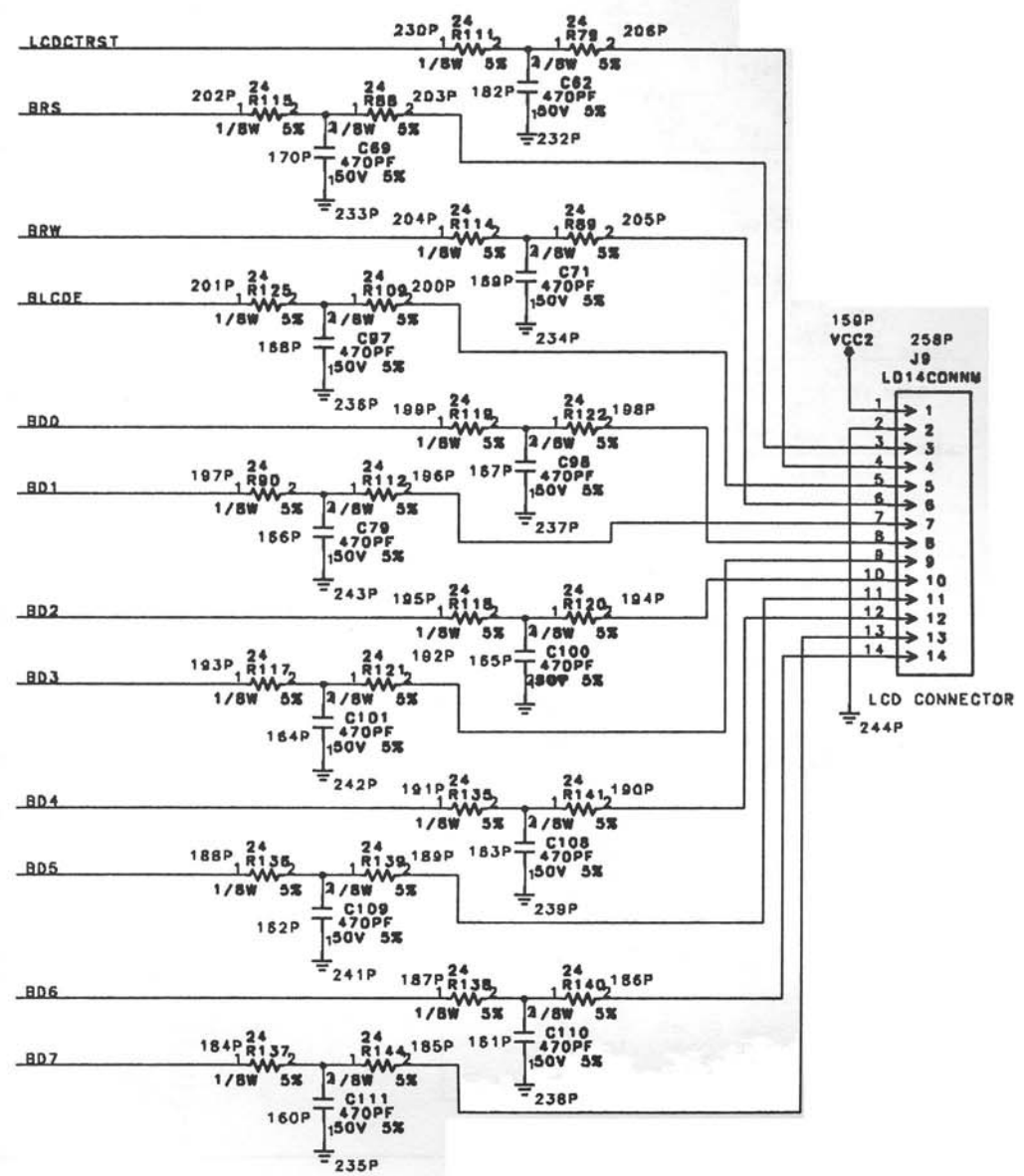
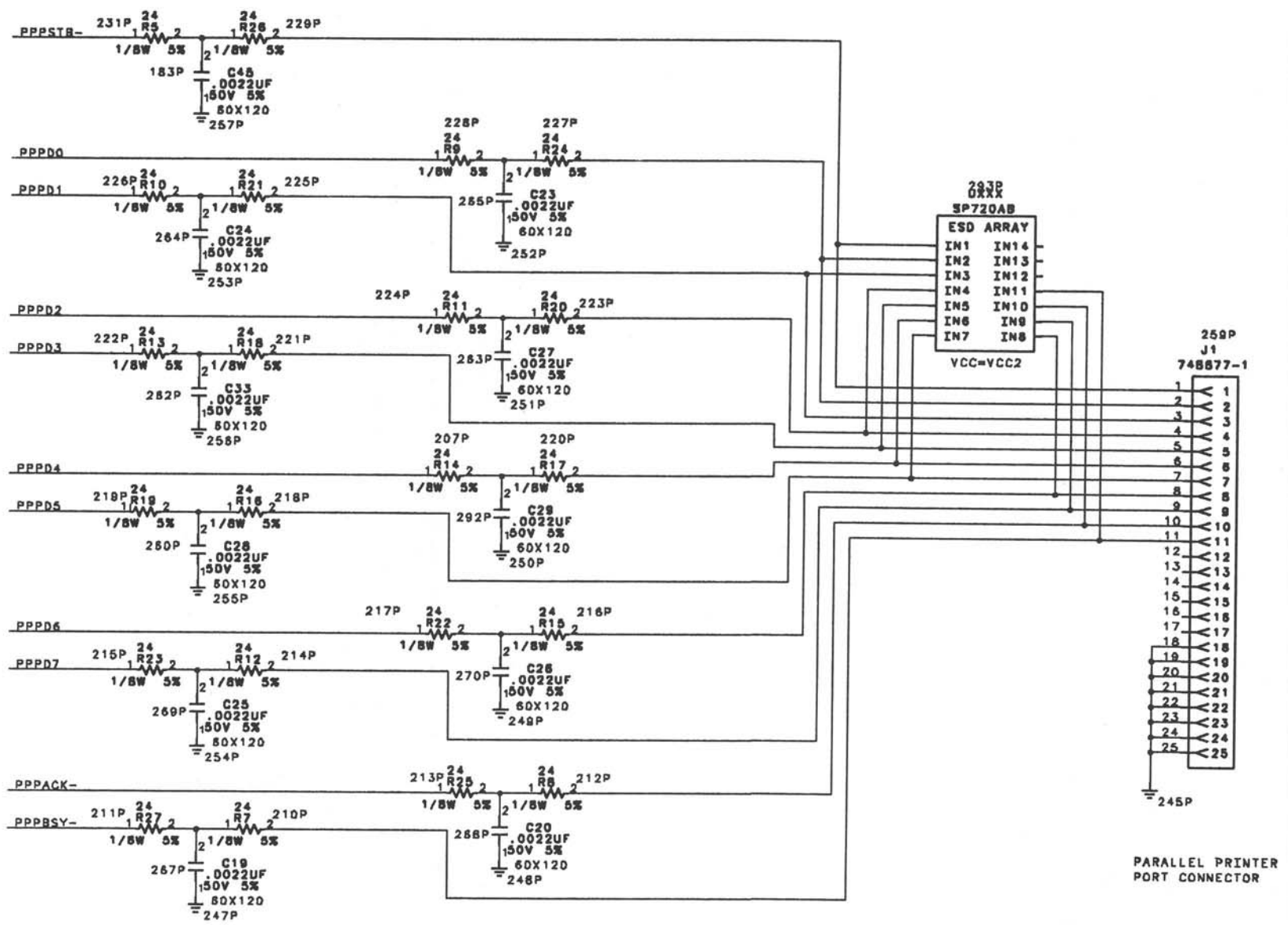
MOTOROLA P/N	DESCRIPTION	REFERENCE DESIGNATOR
	OPTIONAL COMPONENTS	
3005020S19	9 PIN RS232 CABLE	
3062666E02	PRINTER CABLE	
5162848H31	2400 BAUD SINGLE-CHIP MODEM	U5



Power Supply and uP Supervisor (2 OF 6)



Modem and Dial Access Arrangement (3 OF 6)



Parallel Printer Port and LCD PIN Filtering (6 OF 6)

APPENDIX A

TEST FAILURE CODES

RTC RAM TEST

0 RTC RAM test

RTC FUNCTION TEST

0 All tests pass
 1 Unique address RAM test
 2 Walking 1's RAM test
 3 1-second, 12-hour format
 4 rollover, 12-hour format
 5 Feb 28 rollover, non-leap year
 12-hour format
 6 Feb 29 rollover, leap year
 12-hour format
 7 April 30 rollover, 12 hour format
 8 24-hour format rollover
 9 Year 1999 to 2000 rollover, 12-hour format
 10 Year 1999 to 2000 rollover, seconds running,
 12-hour format

RTC TIMING TEST

0 Measure 10 seconds - 20ms
 1 Measure 10 seconds + 20ms

MODEM DIGITAL LOOP TEST

0 Serial port inoperable
 1 Serial port write failure (FF's) and
 2 FF's not looped back
 3 Serial port write failure (0's) and
 4 0's not looped back
 5 Serial port write failure (55's) and
 6 55's not looped back
 7 Serial port write failure (AA's) and
 8 AA's not looped back

MODEM ANALOG LOOP TEST

0 Serial port inoperable
 1 Modem not installed
 2 No carrier detected
 3 Serial port write failure (FF's) and
 4 FF's not looped back

5 Serial port write failure (0's) and
 6 0's not looped back
 7 Serial port write failure (55's) and
 8 55's not looped back
 9 Serial port write failure (AA's) and
 10 AA's not looped back
 11 Serial port inoperable
 12 No carrier detected
 13 Scrambled binary 1s' not detected
 14 Serial port write failure (FF's) and
 15 FF's not looped back
 16 Serial port write failure (0's) and
 17 0's not looped back
 18 Serial port write failure (55's) and
 19 55's not looped back
 20 Serial port write failure (AA's) and
 21 AA's not looped back

MODEM REMOTE LOOP TEST

0 All tests pass
 1 Modem connection failed
 2 Remote loopback request failed
 3 Serial port failed initialization
 4 Serial port I/O write-status error
 5 Single-character loopback fail
 6 First scrambled 1's serial port I/O write fail
 7 First scrambled 1's serial port I/O read fail
 8 Subsequent scrambled 1's serial port I/O
 write fail
 9 Subsequent scrambled 1's serial port I/O
 read fail

KEYBOARD TEST

0 All tests pass
 Never returns a FAIL CODE.

LCD BLANK TEST

0 All tests pass
 1 all pixels are not blank

LCD PIXEL TEST

- 0 All tests pass
- 1 all pixels are not on

LCD CONTRAST TEST

- 0 All tests pass
- 1 all pixels are not changing from full contrast to no contrast

LCD CHARACTER TEST

- 0 All tests pass
- 1 1st row displayed in error
- 2 2nd row displayed in error
- 3 3rd row displayed in error
- 4 4th row displayed in error
- 5 5th row displayed in error
- 6 6th row displayed in error

LCD FUNCTION TEST

- 0 All tests pass
- 1 Compare 1st line with address pattern written
- 2 Verify that cursor automatically advances through line 1
- 3 Compare 2nd line with address pattern written
- 4 Verify that cursor automatically advances through line 2
- 5 Verify that clear command resets cursor to home position 0
- 6 Verify that clear command sets all line 1 display locations to spaces
- 7 Verify that clear command sets all line 2 display locations to spaces
- 8 Verify that home command returns the cursor to line 1, column 0
- 9 Verify that character generator RAM contains address pattern
- 10 Verify that cursor is set to each display line 1 position
- 11 Verify that cursor is set to each display line 2 position
- 12 Verify that cursor is shifted left by the shift-left command
- 13 Verify that cursor is shifted right
- 14 Verify that cursor is shifted left from line 1 col 0 to line 2 col 40
- 15 Verify that cursor is shifted right from line 2 col 40 to line 1 col 0

- 16 Verify that cursor is shifted right from line 1 col 40 to line 2 col 0
- 17 Verify that cursor is shifted left from line 2 col 0 to line 1 col 40
- 18 Verify that cursor position in RAM is not changed when the LEFT SHIFT NO DATA ENTRY command is issued
- 19 Verify that data in RAM is not changed when the LEFT SHIFT NO DATA ENTRY command is issued
- 20 Verify that cursor position in RAM is not changed when RIGHT SHIFT NO DATA ENTRY command is issued
- 21 Verify that data in RAM is not changed when the RIGHT SHIFT NO DATA ENTRY command is issued
- 22 Verify that INSERTION mode inserts a character into the test display message
- 23 Verify that INSERTOFF mode overwrites a character into the test display message

RS232 TEST

- 0 All tests pass
- 1 Subtest for adapter-plug presence (CTS = 0)*/
- 2 Subtest for adapter-plug presence (CTS = 1)*/
- 3 Serial port init status failure 9600 baud, 8 data, 1 stop, CTS/RTS, Full duplex
- 4 Serial port write incrementing pattern status failure
- 5 Serial port read incrementing pattern status failure
- 6 Serial port write 0's status failure
- 7 Serial port read 0's status failure
- 8 RTS de-asserted for 3/4 buffer capacity
- 9 RTS remains de-asserted while buffer is between 3/4 and 1/4 full
- 10 Serial port read incrementing pattern data failure
- 11 RTS is asserted when buffer is 1/4 full
- 12 Serial port read of 1/4-full character position data failure
- 13 Serial port init status failure. 4800 baud 7 data, 1 stop, CTS/RTS, Full duplex
- 14 Serial port write random data status failure
- 15 Serial port random data read failure
- 16 Serial port init status failure; 2400 baud 7 data, 1 stop, CTS/RTS, Full duplex
- 17 Serial port write random data status failure
- 18 Serial port random data read failure

- 19 Serial port init status failure; 1200 baud
7 data, 1 stop, CTS/RTS, Full duplex
- 20 Serial port random data read failure
- 21 Serial port init status failure. 300 baud
7 data, 2 stop, CTS/RTS, Full duplex
- 22 Serial port write random data status failure
- 23 Serial port random data read failure
- 24 Serial port init status failure; 9600 baud
7 data, 2 stop, CTS/RTS, Full duplex
- 25 Serial port write status failure
- 26 Serial port status timeout with RS232
driver disabled

RAM TEST

- 0 All tests pass
- 1 Unique address test
- 2 Walking 1's
- 3 Walking 1's (top 16 locations of external RAM)

RAM NON-VOLATILE TEST

- 0 All tests pass
- 1 Checksum failure

PARALLEL PORT TEST

- 0 All tests pass
- 1 Print CR LF fail
- 2 Print test message string fail
- 3 Print character set test fail

PARALLEL PORT T/O TEST

- 0 All tests pass
- 1 Printer did not time out

POWER SUPERVISOR TEST

- 0 All tests pass
- 1 Watchdog timer did not time out
and shut down unit

POWER THRESHOLD TEST

- 0 All tests pass
- 1 Power did not shut down

POWER-OFF TEST

- 0 All tests pass
Can't display anything. Unit MUST power off.